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THE PHYSIOGNOMY OF THE INDIANS OF SOUTHERN NEW ENGLAND

BY HARRIS HAWTHORNE WILDER

WITHIN the last thirty years a number of skulls of illustrious men have been submitted to anatomists, either to learn their special characteristics or to establish their identity. Thus the skull of Kant was studied by Kupffer and Bessel-Hagen in 1881, that of Raphael by Welcker in 1884, and that of Bach by His in 1895. The supposed skull of Schiller, long cherished at Weimar as genuine, was proven spurious by Welcker in 1882, and the real one was supposed to be lost until, within the last few months, it has come to light, and is now in possession of the anatomist August Froriep.[1] During this series of investigations the detailed relationships between the face of the skull and the fleshy face have become more and more definitely known, until it seems now possible, given either one, to reproduce the other with considerable accuracy. Thus far the study has been confined in the main to ascertaining the average thickness of the soft parts over certain definite points, and then covering the face of the skull with a layer of clay, or other plastic substance, carefully observing the proper measurements at each point. Although this method is confessedly incomplete, it was used with startling results in 1895 in building up the face upon the supposed skull of Bach, results that proved the identity of the

[1] Presented at the annual session of the Anatomische Gesellschaft at Munich in April last (1912). Cf. *Anat. Anz.*, May 13, 1912, for the preliminary report.

skull in question beyond all doubt. (Fig. 50.) Since then the method has been employed a few times, generally in somewhat fanciful cases. Thus Kollmann has reconstructed the face of a Neolithic woman from the lake-village site of Auvernier, Lake Neuchâtel, and Merkel has built up the bust of an early Low-Saxon from an ancient skull, found by excavation in the vicinity of Göttingen.

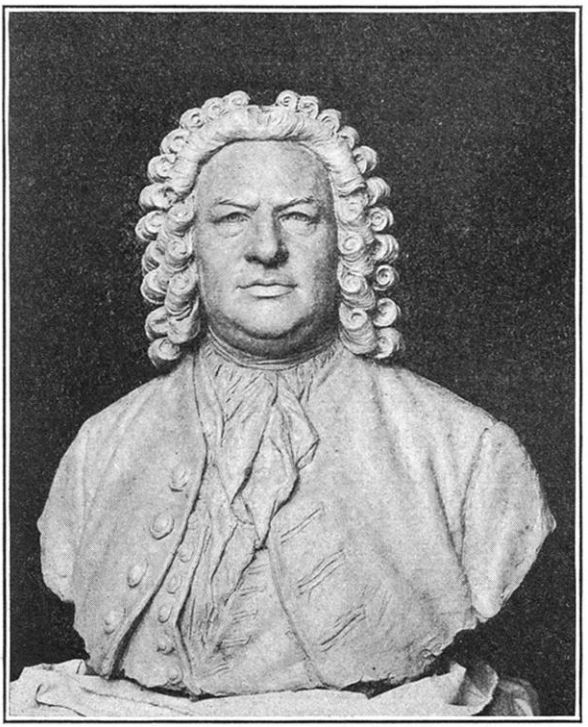


FIG. 50.—Reconstruction of the face of Johann Sebastian Bach; built directly upon the skull by the sculptor Seffner in accordance with the measurements taken by Professor His. (After His, 1895.)

Still, in spite of the real interest in the results, the data for such a reconstruction are not yet complete, and for certain of the soft features, notably the fleshy part of the nose, the lips, and the surroundings of the eyes, there is still much to be done. It is not impossible that even in these details there may be definite correlations between the bony structures and the soft parts, which later research will reveal, and that indications of these exist upon the face of the skull, if they could only be read. For the nose, at least a good beginning of this was made by Welcker in his discussion of the supposed Schiller skull,[1] but there is still much to be done in this direction.

[1] Welcker, *Schiller's Schädel und Todtenmaske*, Braunschweig, 1883, esp. pp. 84–93.

Regarding the general thickness of the soft parts of the face, not connected with the special features, Welcker established the average thickness at nine definite median points, obtaining his data from thirteen male bodies of middle age by means of a small, double-edged knife with a chisel-shaped end. He first ascertained with accuracy the total length of the blade of this instrument, then, at each of the determined points, thrust it perpendicularly through the soft parts until it came to the bone, and measured the part of the knife-blade still remaining. The points taken, with the average thickness at each, are given in the first column of the subjoined table.

Wilhelm His, in 1895, during his investigation of the Bach skull, made further studies in the thickness of the soft parts, using a larger number of bodies, including females, and establishing several lateral points.

To obtain his measurements he abandoned the thin blade employed by Welcker in favor of a sewing needle, set in a handle and bearing a small rubber disk. The needle was oiled and thrust into the flesh perpendicular to the surface, the disk registering the thickness. After withdrawal, the part below the disk could be measured with a millimeter rule.

His first showed the difference in the thickness of the soft parts in bodies of various conditions, and compared the data obtained from 24 male suicides, who were in sound bodily condition, with those from 9 males who had died of wasting disease. His results from the sound bodies in the case of each sex separately are shown in the second and third columns of the table here given.

Still more material was furnished by Kollmann and Büchly three years later, apropos of the reconstruction of the face of the Neolithic female skull aforesaid. These investigators studied the bodies of 21 males and 7 females in various bodily conditions, and added three points to those employed by His; namely, the free edge of the nasal bones (rhinion), previously used by Welcker; the highest point upon the surface of the jugal bone; and the middle of the zygoma. The averages of these 21 males and of the four well-nourished females are given in the table here presented (columns

TABLE SHOWING THE MEASUREMENTS OF THE SOFT PARTS OF THE FACE, ACCORDING TO DIFFERENT AUTHORS, AND IN THE DIFFERENT SEXES AND RACES

Column 1, Welcker, 1883; averages of 13 males. Column 2, His, 1895; averages of 24 male suicides between the ages of 17 and 72. Column 3, His, 1895; averages of 4 female suicides. Column 4, Kollmann, 1898; averages of 21 males. Column 5, Kollmann, 1898; averages of the 24 males of His with the 21 males of Kollmann: 45 in all. Column 6, Kollmann, 1898; averages of four well-nourished females. Column 7, Kollmann, 1898; averages of the four female suicides of His with the four females of Kollmann: 8 in all. Column 8; Birkner, 1903–1907; averages of 6 male Chinese, beheaded. Column 9, Fischer, 1905; averages of two male Papuans. Column 10, von Eggeling: 1909; averages of three male Hereros. Columns 11 and 12, the figures used in the reconstructions given in this paper: New England Indians and others—column 11 for males, column 12 for females. In columns 8, 9, and 10, the black-faced figures are those which are markedly different from the European averages.

		Location of Point	1	2	3	4	5	6	7	8	9	10	11	12
Median	o	Occipital; midway between lambda and rhinion	6.8	—	—	—	—	—	—	—	—	—	—	—
	p	Middle of parietal region	5.3	—	—	—	—	—	—	—	—	—	—	—
	St_1	Forehead; line of hair	—	4.08	4.16	3.07	3.56	3.02	3.59	4.24	3.55	3.93	3.6	3.6
	f	Forehead; middle	4.3	—	—	—	—	—	—	—	—	—	—	—
	St_2	Forehead; glabella	—	5.17	4.75	4.29	4.69	3.9	4.32	5.45	4.1	5.36	4.7	4.3
	Nw	Nasion	5.9	5.45	5.0	4.31	4.93	4.1	4.55	**6.6**	**2.95**	4.76	4.9	4.5
	Nr	Middle of internasal suture	3.3	3.29	3.0	3.13	3.25	2.51	2.78	**5.43**	2.45	3.76	3.25	2.8
	Ns	Rhinion; free end of nasals	2.2	—	—	2.12	2.12	2.07	2.07	2.38	2.9	**3.43**	2.1	2.0
	Ow	Akanthion; base of upper lip at septum	—	11.25	9.75	11.65	11.59	10.1	9.92	11.2	9.6	12.16	11.6	9.9
	lg	Prosthion; middle of hollow in upper lip	11.0	9.37	8.26	9.46	9.48	8.1	8.18	11.65	9.8	**13.63**	9.5	8.2
	K_1	Transverse furrow of chin at base of lower lip	10.6	10.0	9.75	9.84	10.05	10.95	10.35	11.02	9.15	10.46	10.0	10.4
	K_2	Gnathion; point of chin, directed forward	8.5	11.05	10.75	9.02	10.22	9.37	10.06	10.95	9.1	9.8	10.2	10.0
	K_3	Beneath chin, directed downward	—	6.16	6.5	5.98	6.08	5.85	6.18	6.07	5.65	5.26	6.0	6.2
Lateral	oa	Middle of eyebrow, or superciliary ridge	—	5.8	5.5	5.41	5.65	5.15	5.32	**6.63**	5.05	**6.85**	5.6	5.3
	ua	Middle of lower rim of orbit	—	4.9	5.25	3.51	4.29	3.65	4.45	5.52	5.15	**5.65**	4.3	4.5
	wb	Middle of jugal bone, highest point	—	—	—	6.62	6.62	7.73	7.73	**10.0**	**4.9**	7.31	6.6	7.7
	jb_1	Middle of zygomatic arch	—	—	—	4.33	4.33	5.32	5.32	**5.77**	**8.05**	4.46	4.3	5.3
	jb_2	Base of zygomatic arch, near ear	—	6.05	6.75	7.42	6.74	7.1	6.92	**8.59**	7.4	**11.03**	6.7	7.0
	Uk	Side of mandible, in front of masseter	—	8.37	8.1	7.76	8.20	6.16	7.13	7.08	**10.1**	9.68	8.2	7.2
	Ms	Middle of ramus, through masseter	—	17.55	17.0	17.01	17.53	14.83	15.91	**20.05**	**20.5**	18.63	17.5+	16+
	Kw	Gonion; angle of jaw	—	12.08	11.5	8.72	10.46	7.56	9.53	11.73	**17.5**	13.61	10.5	9.6

4 and 6). Furthermore, these authors, in addition to their own data, added the 24 normal male individuals measured by His, and thus obtained a combined average of 45 normal male individuals (column 5 of the table). For females the data are still meager, but Kollmann and Büchly again combined the results from their four well-nourished female bodies with those from the four female suicides of His, and obtained a combined average of the data from 8 individuals (column 7).

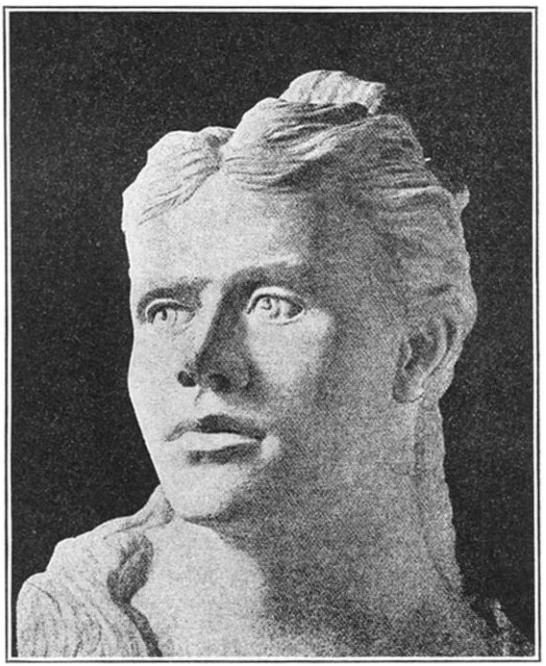


FIG. 51.—Face of a Neolithic Swiss woman from the lake-village site of Auvernier, on Lake Neuchâtel. Built directly upon the skull by Kollmann and Büchly, 1898. (After Kollmann.)

For obtaining their measurements these authors employed a needle, as did His, but instead of using the rubber disk, they blackened the needle with soot from a candle flame before each application. Contact with the flesh rubbed off the soot, and after withdrawal the soot-free part was measured.

The final result of these investigations, here reproduced (fig. 51), is very pleasing, and represents a young woman of rather masculine type, with a markedly Swiss countenance: a good model for a statue of Helvetia.

A second attempt to recall the past, but one not so distant, through plastic reconstruction, was made by Merkel in 1900, who, with the assistance of the sculptor Eichler, built a face upon the skull of an ancient Saxon, found in the neighborhood of Göttingen,

and estimated to be between 1200 and 1400 years old. This work, however, differed in method from the preceding, for Merkel often departed widely from the prescribed data, following rather his own deductions concerning the development of muscles and other parts, as suggested by the lines and features of the skull; yet again, as with Kollmann, the result was extremely pleasing although it cannot well be tested (fig. 52). Upon looking at these striking and very effective results one cannot help thinking of the influence of the professional sculptor who performed the plastic part of the work in each case, and the feeling is strong that much that is satisfying in the result may be due to the skill of the artist, although without any conscious attempt on his part to express an ideal.

FIG. 52.—Bust of a Low-Saxon of 500–700 A.D.; built upon a skull from the Leinegau district of Germany, near Göttingen, by Merkel, 1910. (From Eggeling, after Merkel.)

In the direction of racial measurements Birkner, in 1903–1905, measured carefully the heads of six beheaded Chinese, and came to the result that in racial anatomy the soft parts vary more than the skulls, and that the racial differences in the thickness of soft parts are very considerable. Fischer, in 1903, measured the soft parts

of two Papuans, and von Eggeling, in 1909, studied in the same way the heads of four Hereros. The results of these (Chinese, Papuans, Hereros), although they include only a very few individuals, are here added for comparison with the others (columns 8, 9, and 10), and serve to emphasize Birkner's conclusions. Von Eggeling, from whom these last figures are taken, calls attention to the most striking departures from European averages by the use of heavy type, and this method is here reproduced. Thus one sees at once that in the Chinese the base of the bony nose, at the fronto-nasal suture, is sunk much deeper in the flesh, and in the Papuans it is more superficial, than in Europeans; also the traditional thickness of lip in the negro is shown by the thickness at the prosthion in the Herero. In the lateral points there is a greater thickness of flesh over the superciliary ridges in both Chinese and Herero, while in the surroundings of the eye the Papuans are about the same as Europeans. Other marked points of difference are in the cheeks of the Chinese, and in the masseteric region of all three races, where the measurements considerably exceed those of Europeans.

These last three investigators, Birkner, Fischer, and von Eggeling, employed in their work the soot-covered needle of Kollmann, but for this purpose a special instrument has recently been prepared by Czekanowski (1907), consisting of a needle that slides in a brass tube. In this latter is a graduated slot. This indicates the extent of projection of the needle beyond the lower edge of the brass tube, which is disk-shaped and lies flat upon the surface of the skin.

Interested now for several years in these European attempts at reconstructing faces upon skulls, I determined to apply the methods to the skulls of New England Indians, in a region where the extermination of this race has been so complete that no living representatives are now left except two or three small communities where intermarriage with other races, especially Negroes, has been long continued (e. g., Gay Head, Mass; Charlestown, R. I.).

For data I took, in general, those of Europeans, reducing the figures, however, to a single decimal, as a figure in the hundredths place can have no meaning in practical application. Thus reduced, the figures for the two sexes, as used by me, are indicated in the two last columns of the table (columns 11 and 12).

Since, however, a few striking racial differences are to be expected, I allowed the general contours and proportions of the skulls used to effect a few modifications when the indications seemed to demand it. Thus, through the masseter, where the average Euro-

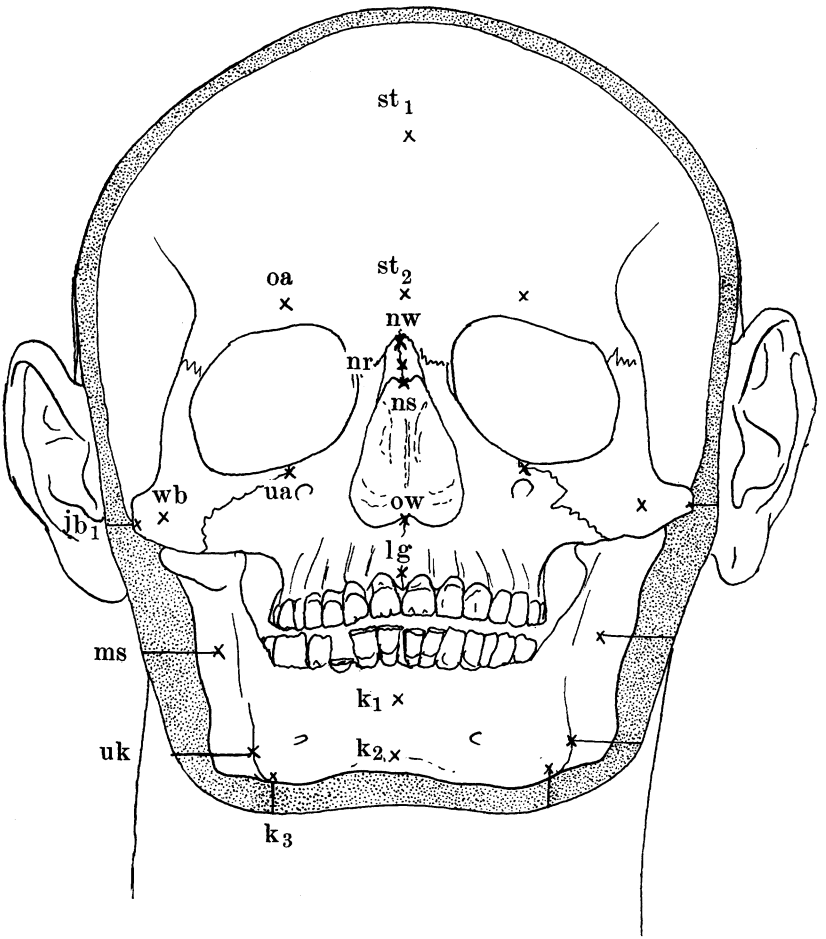


FIG. 53.—Location of the established points upon the face; front view. (After Kollmann and Büchly.)

pean measurement of 16–17 mm. gave the region a hollow appearance, I increased the thickness to 20 or even more, using as an indication the zygomatic arch and the configuration of the area of

insertion of this muscle upon the mandible. In most respects, however, I adhered closely to the European data.

Regarding the plastic material, and the methods of application,

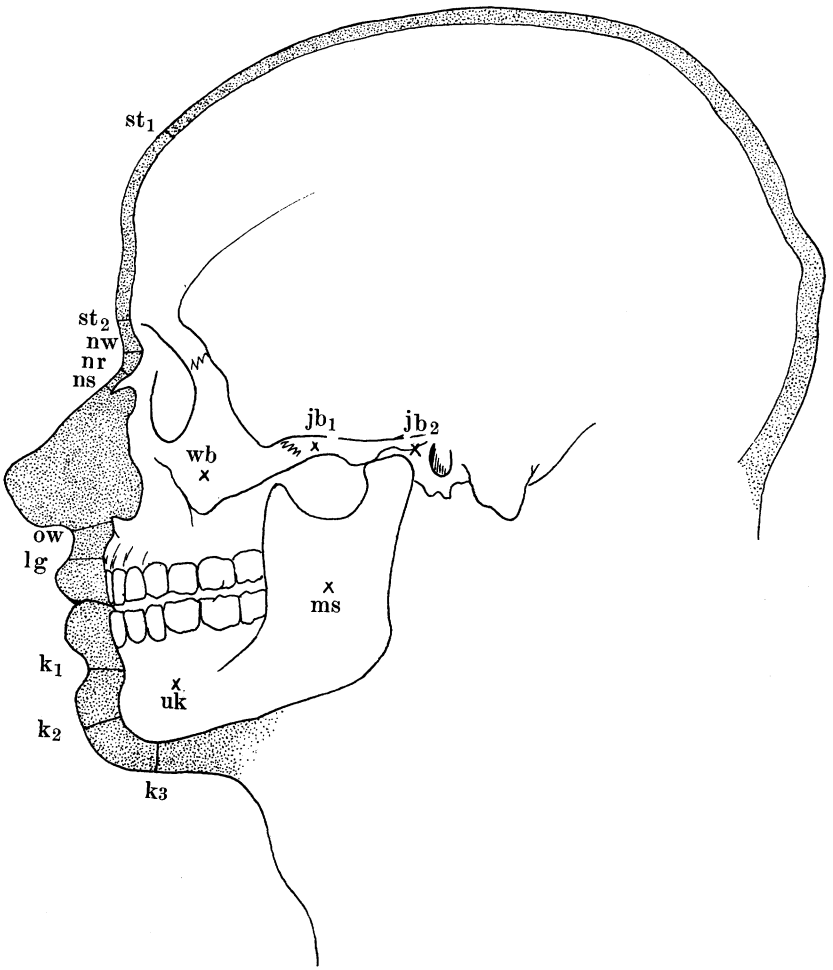


FIG. 54.—Location of the established points upon the face; side view. (After Kollmann and Büchly.)

His and Kollmann used clay, which they spread over the skull, as guided by the points of known thickness, previously built up in the form of pyramids of plaster of Paris, and accurately measured.

Merkel substituted plastilina for ordinary clay, a procedure which has since become universally adopted. Concerning the method of obtaining the exact thickness at the established points, I have used little strips of ordinarily thick writing paper, about a millimeter wide. The strip is bent near the middle into two portions at right angles to each other, and one of them is cut down to a length that corresponds exactly to the required thickness. The unmeasured portion is then used as a standard or foot, and fastened down to the surface of the bone with a little piece of plastilina, while the other piece projects perpendicularly. By carefully building up on both sides of this with more plastilina, any bending of the measuring strip is prevented. I also find it more advantageous to build up the surface as fast as the measures are located, rather than first to cover the skull with these structures; and thus, during the progress of the work, an entire side or the upper part of the face may be completed while the remainder of the skull is still bare.

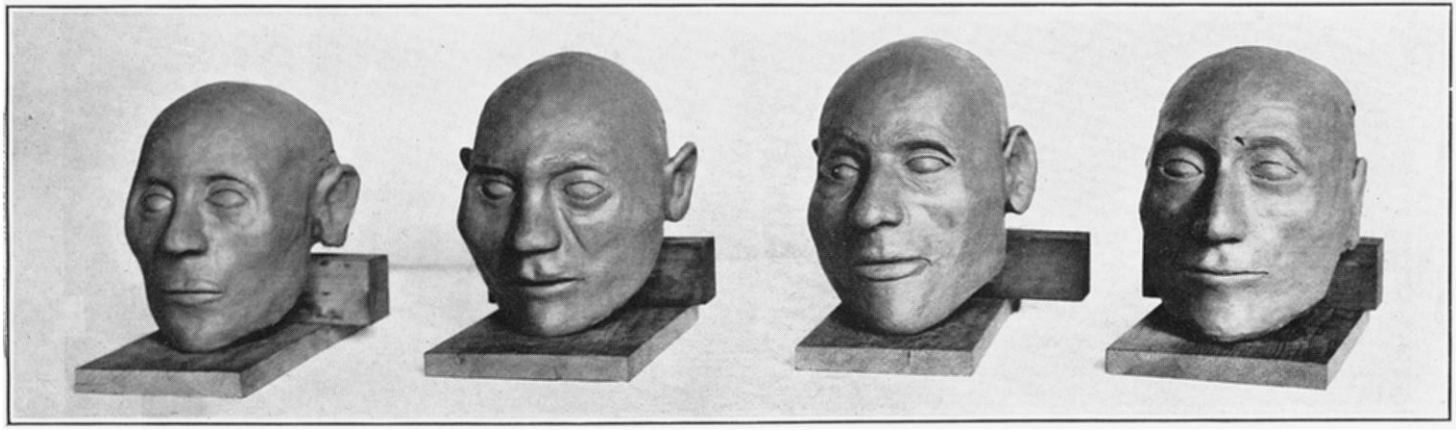
After their enclosure in the plastilina the little paper strips are as firm and reliable as the plaster pyramids, and the fine white lines of the square-cut ends are always sufficiently obvious. If covered up during the progress of the work they may be found in a moment by rubbing over the spot, and may with equal readiness be concealed at the final finishing of the surface.

The skulls selected for reconstruction include a man and a woman of the Narragansett tribe in Rhode Island, and two men, presumably Nonotucks, from Hadley, Mass., exhumed about four miles from each other.

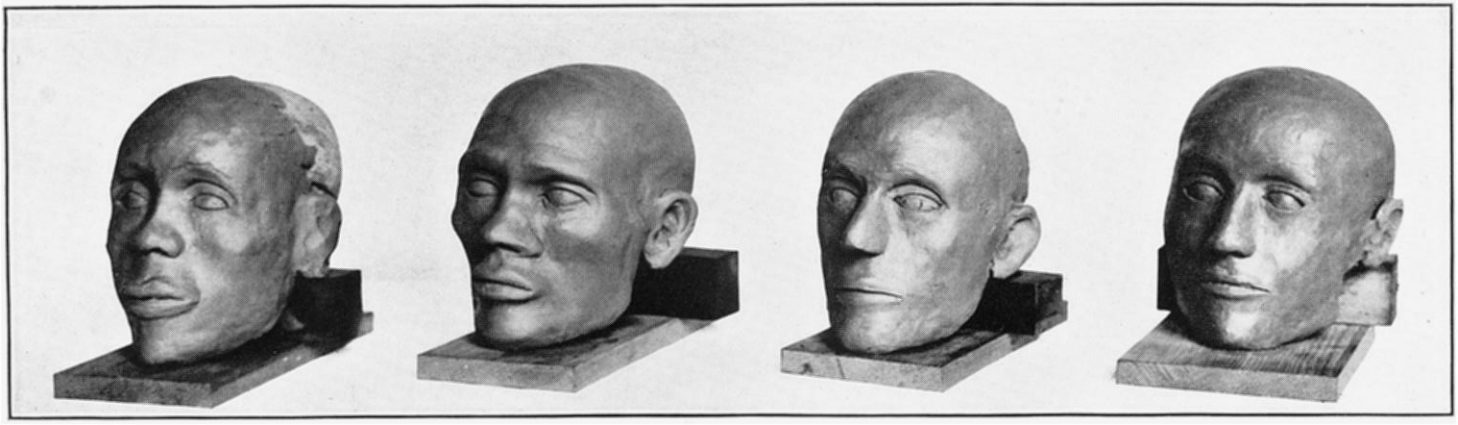
The details of the four skulls are as follows:

1. Narragansett (male). Exhumed in Jamestown, R. I. (Canonicut Id.)
2. Narragansett (female). Sub-type: Niantic. Exhumed from "Indian Burying Hill," Charlestown, R. I.
3. Nonotuck (male). Exhumed in Hadley, Mass., at "Indian Hill," near Hockanum, on east bank of Connecticut river.
4. Nonotuck (male). Exhumed in North Hadley, Mass., on east bank of Connecticut river.

The first of these is No. 41763 of the collection of Phillips Academy, Andover, Mass., and was kindly lent to me by the



RECONSTRUCTIONS, IN PLASTILINA, OF FOUR NEW ENGLAND INDIANS



RECONSTRUCTIONS, IN PLASTILINA, OF TWO NEGRO MALES AND TWO WHITE FEMALES

curator, Mr Warren K. Moorehead.[1] The second is a skull of real historical value, being that of a daughter of the Niantic chieftain Ninigret. She died young in 1660, and was buried in a log sarcophagus, surrounded by articles of value, in a parcel of land set apart for the purpose by her father, who followed in this the custom of the English. Her body was exhumed in 1859, apparently out of curiosity, but by good fortune the skull came eventually into the possession of Dr Usher Parsons of Providence, who presented it before the Rhode Island Historical Society, in 1862, and published his paper in the *Historical Magazine*, Feb. 1863, pp. 41–44. Through his son, Dr Charles W. Parsons, the skull came into the possession of Brown University, and was entrusted to me by the present director of the Museum there, Dr Albert D. Mead. To both him and Mr Moorehead I wish to acknowledge my indebtedness.

The other two skulls are local, and belong to the Smith College collection. The last was excavated in October 1904, and an account of it was published in the *American Anthropologist* for April–June 1905, pp. 295–300.

In the first row of pl. XXV are given the photographs of the reconstructions in plastilina, built directly upon the skulls by the use of the measurements given above. In this row the order is a chance one, in which the young Narragansett woman comes first upon the left, followed in order by the North Hadley young man, the Narragansett man, and the man from Hadley (Hockanum).

To test the method as to both racial and individual characters I also built up faces in the same manner, and with the same measurements, upon the skulls of two negro males and two white females, and the results of these are given in the second row of the same plate. The first on the left is that of a negro male of 30 years, from the Medical Department of the University of Missouri. The body was obtained from the Fulton Asylum, and the cause of death was recorded as pulmonary tuberculosis.

The history of the second head, also a negro, is peculiar, as it represents to a certain extent a test of the accuracy of the method.

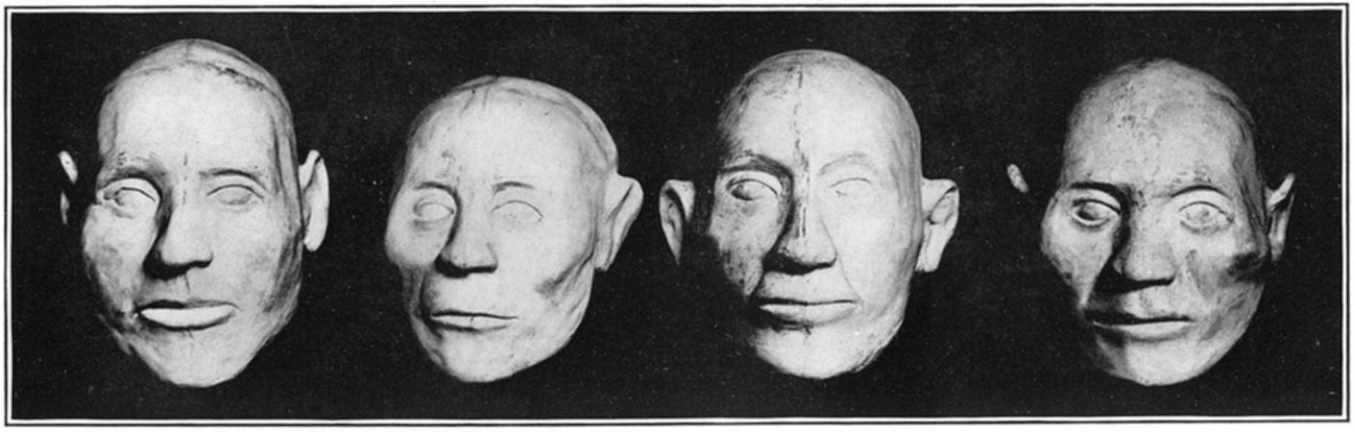
[1] An accompanying label reads: "Skull of New England Indian. Presented by Ferdinand Ambrust, Jamestown, R. I."

This skull was one that I prepared some 25 years ago, and I still remember in a general way the appearance of the face before preparation. I purposely, then, selected it for use in teaching the method to a young man of Northampton, Mr Leigh Hoadley, who sometimes aids me as a volunteer assistant. I taught him the general methods of building up the proper thickness at the various points, and located the points for him; then, without saying anything whatever about the skull, save that I had prepared it, dismissed him to finish the work by himself. Naturally one cannot rely too much upon the memory of such a thing as the face of a dissecting-room subject after so long a time, but when, on the next day, Mr Hoadley brought me his finished result, as given here, it recalled the face of the subject and the circumstances very distinctly and appears to me a good copy of the original.

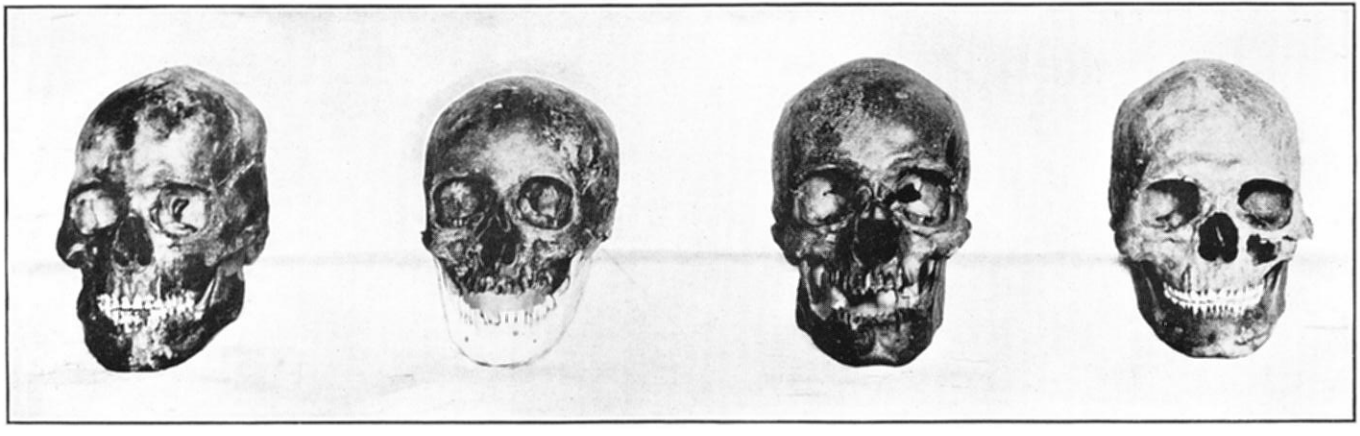
The third and fourth of the series are those of young white women, the third prepared in New York forty years ago, and the fourth a skull purchased from Ward, of Rochester. The reconstructions were very hastily done, merely as tests of race, but seem satisfactorily European.

The first row in pl. XXVI was photographed from the finished casts, which were done in plaster direct from the plastilina, but since the white color offers some advantages to the camera, and especially since the original models received considerably more smoothing and finishing after the photographs of pl. XXV were taken, it has seemed best thus to present them again in their finished form.[1] They are, furthermore, arranged here in the order of the list given above, the two Narragansetts, man and woman, upon the left, the two Nonotucks from Hadley upon the right. The second row shows the skulls of the same, in the same order, taken after the removal of the plastilina subsequent to the casting. In the case of the young Narragansett (Niantic) woman the mandible was wanting, and the substitution was made of a fairly well-fitting piece from a female white skull. In completing the restorations, however,

[1] The work of casting my plastilina originals in plaster was most skilfully carried out by Mr E. A. Thompson, of Amherst, to whom also I am indebted for the final finishing of the surfaces.



PLASTER CASTS OF THE PLASTILINA RECONSTRUCTIONS, ALTHOUGH IN A DIFFERENT ORDER (SEE TEXT)



SKULLS USED IN THE RECONSTRUCTIONS. THE ORDER OF THESE TWO ROWS CORRESPONDS

it was soon found that the usual measures could not be used for the substitute jaw, and the plastilina was put on quite without reference to the contours of the bone, the attempt being made only to present a jaw and chin similar to that of the other Indians, but weaker and more feminine. In doing this the substitute bone was left quite bare in places, while in others it was buried beneath a mass of plastilina which had no anatomical meaning, thus clearly showing the individual, and perhaps also the racial, character of skeletal parts.

Thus, in studying this historically important face, it must be constantly kept in mind that the jaw and chin, from the mouth down, are hypothetical; yet, if one cover this portion with the hand, it will be seen that the part thus supplied is non-essential, and scarcely alters the general expression. Any great departure in facial expression and contour from the present restoration could be occasioned only by the slight chance that the young woman may have had some very individual and peculiar type of jaw, like her associate, the Narragansett man, which is not likely. If these parts were originally of the usual type the young daughter of Sachem Ninigret must have looked very much as here presented.

To emphasize still further the personality of this Narragansett pair they are presented by themselves, on a somewhat larger scale, in plate XXVII. In this they are posed a little, to appear more as people are generally seen, and a bit of cloth is twisted about the head of the young squaw, to obviate the bald appearance of the restoration without hair. As a matter of fact, when exhumed, a large quantity of hair was still present; and even now, upon the more sheltered part of the occipital bone, there is a thin crust of foreign substance, which consists mostly of short pieces of hair, closely felted together, and bleached to a light yellow brown.

Concerning the Nonotuck Indians we have almost no historical account except the mark of a few of them upon local deeds mostly made out to the Pyncheon company at Springfield. They were more or less under the control of the more powerful Pocumtucks to the north of them, who possessed a chief settlement at or near the present Deerfield. Their restoration has thus a special interest, as it

supplies data that were supposedly lost forever. The face of the young man from North Hadley (pl. XXVIII) is an interesting type because of its extreme shortness and broadness. Measured upon the skull, the breadth between zygomatic arches (estimated, because of a deficiency upon the right side) is 137 mm., the same as in the larger skull of the other Nonotuck. This, when compared with a nasion-prosthion line of 63, gives a superior facial index of but 46. This index in the other Nonotuck is 53.3, and in the male and female Narragansetts respectively 52.6 and 56.4. Both from the physiognomy, the cranial capacity of 1275 c.c., and the absence of all associated artifacts in his grave (*American Anthropologist*, 1905, l. c.), it is safe to conclude that in this young man we have simply one of the rank and file, an ordinary person of low rank, and, probably, of limited intelligence. The cranial capacity of the other Nonotuck is 1473, and that of the Narragansett man is 1370. The little Niantic squaw, as would be supposed from the small size of the skull, has a small cranial capacity, only 1245 c.c., but the remarkably good frontal contour, the cerebral portion of which is very high, quite compensates for the lack of size, especially in a presumably small body, and argues a high degree of intelligence. If we compare this frontal contour (as taken with the Lissauer diagraph) with that of her three associates, we find that in her case the contour gives a frontal contour angle of 131°, as compared with the flatter angles of 132.7° for the large Nonotuck, 136.8° for her Narragansett associate, and 140° for the little, unintelligent man from North Hadley.

To these few anthropometric data, which are taken from a more extended work in preparation upon the skulls of New England Indians, there may be added the usual cranial indices, together with the total maximum length and breadth measurements. These, with the latter placed in fractional form, as in obtaining the cranial indices, are as follows:

1. Narragansett (male) $\frac{126.5}{185} = 68.3$.
2. Narragansett (female) $\frac{137}{174} = 78.74$.
3. Nonotuck (male). The larger one $\frac{139}{182} = 76.37$.
4. Nonotuck (male). The smaller one $\frac{134}{182.5} = 73.42$.

CASTS OF THE RECONSTRUCTED HEADS OF TWO NARRAGANSETT INDIANS. THE ONE ON THE LEFT IS THE YOUNG DAUGHTER OF SACHEM NINEGRET, THE OTHER A MAN FROM CANONICUT ISLAND

By this the Narragansett male specimen is shown to be extremely dolichocephalic, a striking character of the original skull, while the young squaw has an unusually broad head for a New England Indian. The others are more nearly the usual form, and this, as well as in the other features, appear as good types of their race.

In criticizing the actual value of the method of restoration the weak point is seen at once, namely, the opportunity for imagination on the part of the manipulator in the case of such features as the lips, the soft parts of the nose, and the setting of the eyes. The room for the personal equation is, however, not nearly so great as it would seem, for although not all the possible correlations between these soft features and the underlying and supporting hard parts are as yet known, at the same time the range of possibilities for the working of the imagination is seen to be much restricted when one attempts for himself an actual restoration.

In the nose, for example, the nasal bones often extend a long way down the profile, and give such a definite beginning to the outline that, with the terminal limit distinctly marked by the akanthion, there is practically but one possible way of completing the contour. The lower outline of the piriform fossa locates the point of attachment of the septum and the position of the two nostrils; and by the level of these last two, as well as by the shape of the bony septum, one can learn whether the nose was straight or scoliotic, and, in the latter case, to what degree. The breadth between the wings can be obtained with considerable exactness by obtaining the nasal index in the skull and ascertaining the index of the living face to which this value corresponds. For an exact correspondence we are perhaps not yet ready, but, to start with, the points generally accepted in each case as the boundaries between the classes of nasal indices may be taken as equivalent. Thus, on the skull a nasal index of 47 is the lowest number of the mesorrhine class, while in the case of the living this place is held by a nasal index of 70. Thus the numbers 47 and 70, in the two cases, skull and living, may be considered as about equivalent, and the same may be postulated of the indices 58 and 100 respec-

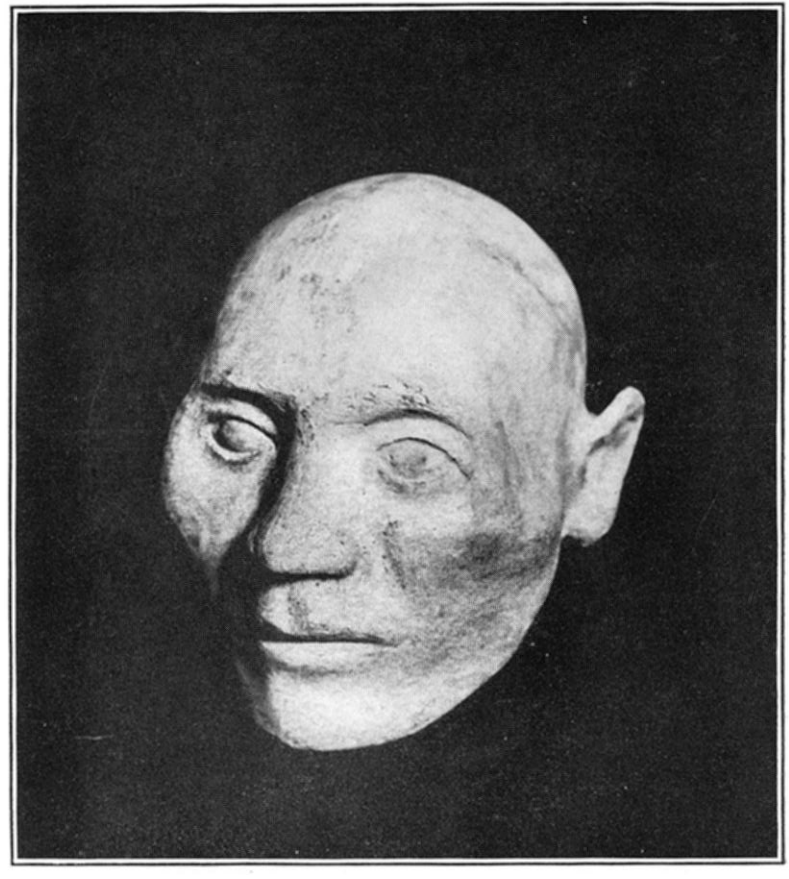
tively, which mark the entrance into the class of platyrrhine, or chamærrhine, noses. Starting with these as fixed points of comparison, it will be seen that every single point in skull indices corresponds to three on the living, or, beginning with 48 = 70, we have 49 = 73, 50 = 76, and so on. Now, if these figures be taken as approximately correct, one can easily find from the nasal index of the skull that upon the face of the same individual while living, and since the length is the same in both conditions (nasion-akanthion), with the termini precisely indicated, one may thus readily obtain the exact breadth of the fleshy nose between the outer limits of the alæ.

With the mouth the data are at present somewhat less precise, but from a few observations upon the living, the oral slit, when the mouth is in repose, seems to coincide with the line formed by the edges of the upper teeth, and to extend upon each side to about the middle of the second premolar (bicuspid) tooth.[1] These points may be fixed upon the skull, while at work, by inserting pins or small toothpicks and fastening them in the proper position by plastilina. They will thus remain in place, and give the proper location for the external features, during the subsequent progress of the work and at any level to which the plastilina is built. When the mouth is nearly completed they may be withdrawn and the holes obliterated.

The size and fulness of the lips themselves, although not given directly, are strongly indicated by the fixing of the median points above and below them, the center of the hollow of the upper lip, which in the living is directly over the prosthion upon the skull, and the center of the transverse furrow of the chin, which marks the base of the lower lip. These points, with the slope of the alveoli and teeth, together with the exact position of the mouth slit, hedge the problem around with so many conditions that there is slight opportunity for the manipulator to vary his work, or to construct more than one type of mouth upon a given skull. In determining the two median surface points it might be better, in the

[1] Merkel determined a constant direct relation between the extent of development of the jaw muscles and the length of the oral slit.

PLASTILINA RECONSTRUCTION OF A YOUNG NONOTUCK MAN FROM NORTH HADLEY, MASS. EXHUMED BY SMITH COLLEGE IN 1904



CAST TAKEN FROM THE PLASTILINA RECONSTRUCTION SHOWN AT THE LEFT, AFTER FINISHING

case of a negro skull, to use the measurements given for the Hereros, but even with European measures, as were employed in the two negro reconstructions given here, the thickness of the lips seems sufficiently marked, with only the slant of the alveolar surfaces as a basis.

The construction of the eyes became transformed from an unsatisfactory sort of guesswork to a simple and fairly precise piece of work by a method which developed during the course of my study, and the result will appeal to one from the underlying anatomical principles upon which it is based. For each orbit I construct a plastilina eyeball, of the proper size to allow a sufficient space for the eye-muscles, glands, and other surrounding structures, and fix this immovably upon a little bed of cotton, previously packed into the deepest part of the orbit. In the placing of this eyeball there is still some lack of precision in its forward and back location, yet it will be seen from the study of living people that in most cases a wooden ruler or other firm object with a straight edge may be placed vertically over the closed eye and just come into firm contact with the superciliary ridge, the lower lip of the orbit, and the surface of the lid-covered eyeball. As all three points of contact are covered with skin of approximately the same thickness, this means that, on the average, the plastilina eyeball should be set in until the upper and lower lips of the bony orbit and the front surface of the ball are in line.

As a check upon this we have the orbital index (I use the Adachi method), and where this is large, indicating a round orbit and a large, full eye, I allow the ball to project a little, while in the opposite case it may be sunk in, a little back of the usual position. Indians, for example, are generally hypsiconch (megaseme), with large and projecting eyeballs, and in life the form of these latter is often seen through the skin considerably beyond the palpebral opening.

The position of the two canthi is almost precisely determined, the inner by the naso-lacrymal duct, and the outer by a slightly but definitely indicated "malar tubercle," to which attention has recently been called by Whitnall.[1] As in the case of the features

[1] *Journal of Anat. and Physiol.*, 1911.

of the mouth, these points can be kept through all the manipulations by means of pins.

Having determined so much, after the external skin surface has been laid on entirely around the orbit, as far as its margin, the surroundings of the eye may be completed by laying on the lids. These are best made by themselves, of an approximately proper size and thickness, and then fitted to the conditions after being laid on. Here, as elsewhere, the final finishing is done by means of the usual wooden tools which sculptors employ, cut into various shapes, and consists mainly of cutting and smoothing the free edges of the lids, smoothing the eyeball, emphasizing the canthi, and so on. The final result is an eye of some anatomical detail, the essential parts of which are definitely determined from indications furnished by the skull.

For the external ear I have as yet no data other than that of position, as given by the auditory opening. In this it must be observed, as pointed out by Welcker in 1883 (*Schiller's Schädel*, p. 61), that the openings of the external ear and of the skull do not coincide, but that the latter lies upon the average 5.3 mm. farther back, and the same distance higher than the other. Much is to be expected of the careful study of the external ear of different races, as now investigated by Bean, so that in the future it will be possible to add to a reconstruction at least the conventional ears of the race to which the individual belongs. In the case of the young Indian from North Hadley I have purposely set the ears well out, since the face and head seem to suit that form. The case is wholly without other basis, but with regard to both this and the other reconstructions it is to be observed that in a head shorn of hair, as these all are, the external ears appear more prominent than when the hair is present.

Undoubtedly a more detailed study of these special features—nose, mouth, and eyes—in a large number of bodies, and the subsequent study of the macerated skulls of the same individuals, would add greatly to our knowledge of the definite points indicated in the bone, and would render the reconstruction of these features much more exact than at present. There are undoubtedly many

more correlations between the soft features and the underlying hard parts that we have not yet learned to read, since, theoretically, every change in the first, in a region where the two are so intimately associated as in the face, must cause corresponding modifications of the latter. The droop of a lip, or increased weight in an eyelid, presumably brings with it some change in the underlying bone, and these correlations we may sometime learn to read.

It is very probable, too, that we may obtain some help from an allied line of investigation now being extensively followed, namely, the study of the facial muscles in the different human races (Ruge, Popowsky, Forster, Fischer, von Eggeling, Loth, and many others). The facts thus obtained will be of direct service in informing us which lines to emphasize, and which surfaces to strengthen in building up the faces of different racial types, and will probably serve to guide us to many of the correlations we seek by pointing out the places where such are likely to be found.

In two points only, that of the bodily condition of the subject, whether well-nourished or emaciated, and that of the presence and location of wrinkles, two closely associated superficial characters that differ at times in the same individual, can the skull not be expected to furnish much information; and inasmuch as these details, superficial as they are, are generally much relied upon in the sight recognition of individual faces, the method here discussed will always, to the unscientific, have its deficiencies. Even here, however, certain of the deeper folds and wrinkles can be inferred from the general relations and amount of development of the other parts, and assuredly many of the traces of senility are very apparent in the bones. It is thus quite warrantable for us to adopt even the extreme view of Holl, that "der Formenreichthum der skeletirten Gesichtsschädel ist ein so grosser, dass jeder dieser eine bestimmte Physiognomie aufweist; sie sind von einander gerade so verschieden, wie es die Gesichter der Lebenden sind."[1]

This extreme individuality of the bony faces in skulls is not easy to recognize, since not even a professional craniologist experiences the daily and hourly drill in the selection and comparison

[1] M. Holl, Ueber Gesichtsbildung, in *Mitt. anthrop. Ges. in Wien*, 1898, p. 57.

of features which we all of us experience from our infancy in the case of faces, but by spreading over a skull a plastic mass of a definite thickness the surface with which we are all familiar is brought out, and the individuality at once appears.

As a method the results seem, at least, satisfactory, but it needs not only many new observations concerning the correlation of hard and soft parts, but also a large number of tests like that of the negro skull above mentioned, where, by death-masks, photographs, or actual acquaintance, the appearance in the flesh may be put on record, and compared with the completed restoration, made by an operator kept in ignorance of the records.

When perfected, there is practically no end to the application of this reconstruction method. Not only is there an important medico-legal aspect of the case, in the numerous instances in which the identity of a given skull comes in question, but the same question comes up frequently in such cases as those of Bach and Schiller. Of the 278 skulls recently obtained from the wreck of the *Maine* but few could be identified, and these only by swords and other associated objects. Had the skulls been reconstructed by this method, it is probable that with the coöperation of relatives and former friends, but very few would have remained unidentified.

Other important applications are the reconstructing of ancient or prehistoric skulls, like those of the ancient Cretans, Oscans, Etruscans, and so on, or those of the Romans of classic times, notably those from Pompeii. These latter would be of especial interest, since they could be directly compared with the sculptured portraits found in association with them, occasionally, perhaps, portraits of the same individuals or of near relatives. The Roman Church, also, has preserved as relics many an ancient skull, with a more or less authentic record, and in such cases the historical interest might often be considerable.

There is much need of work in this direction, and the writer of this paper would welcome any coöperation. The method itself is so simple that it can be readily performed by any one who follows the directions here given, and the very first attempt cannot help being at least moderately successful. The subject is already receiving

considerable attention in Europe, as may be seen by the work of the last session of the Anatomische Gesellschaft at Munich (April 1912), the program of which included the presentation of the genuine skull of Schiller by Froriep, as already referred to, and the demonstration of several new plastic reconstructions by von Eggeling. In the skulls of our aborigines we in America have some interesting and important material, the study of which may thus be furthered.

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